Modeling the Impacts of a NY Renewable Portfolio Standard

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NY RPS Modeling Workshop

June 27, 2003

Overview

- Background
  - Supply curve model development team involvement in similar processes
  - What have we been asked to do?
- RPS modeling approach
- New York RPS Analysis
  - Defining the parameters
  - The full analysis (how do we fit in the bigger picture)
  - Building the supply curves
  - Preliminary block definitions
  - Data sources
  - Simplifying assumptions

Background – Model Development Team

- Sustainable Energy Advantage team (including LaCapra Associates) under contract to NYSERDA
  - Have provided support to multi-stakeholder RPS modeling efforts in MA, CA, WI, and RI
- In early June, DPS asked us to assist with simplified supply curve analysis on a compressed timeframe
  - Evaluate and recommend modifications to DPS's approach
  - Help DPS and NYSERDA define and set up analysis similar to approach used by SEA team in MA, WI, CA RPS analyses; NY Executive Order 111 analysis
  - Develop supply curves as input to DPS analysis
  - Provide peer review of DPS analysis
  - Co-author report

The RPS Modeling Approach

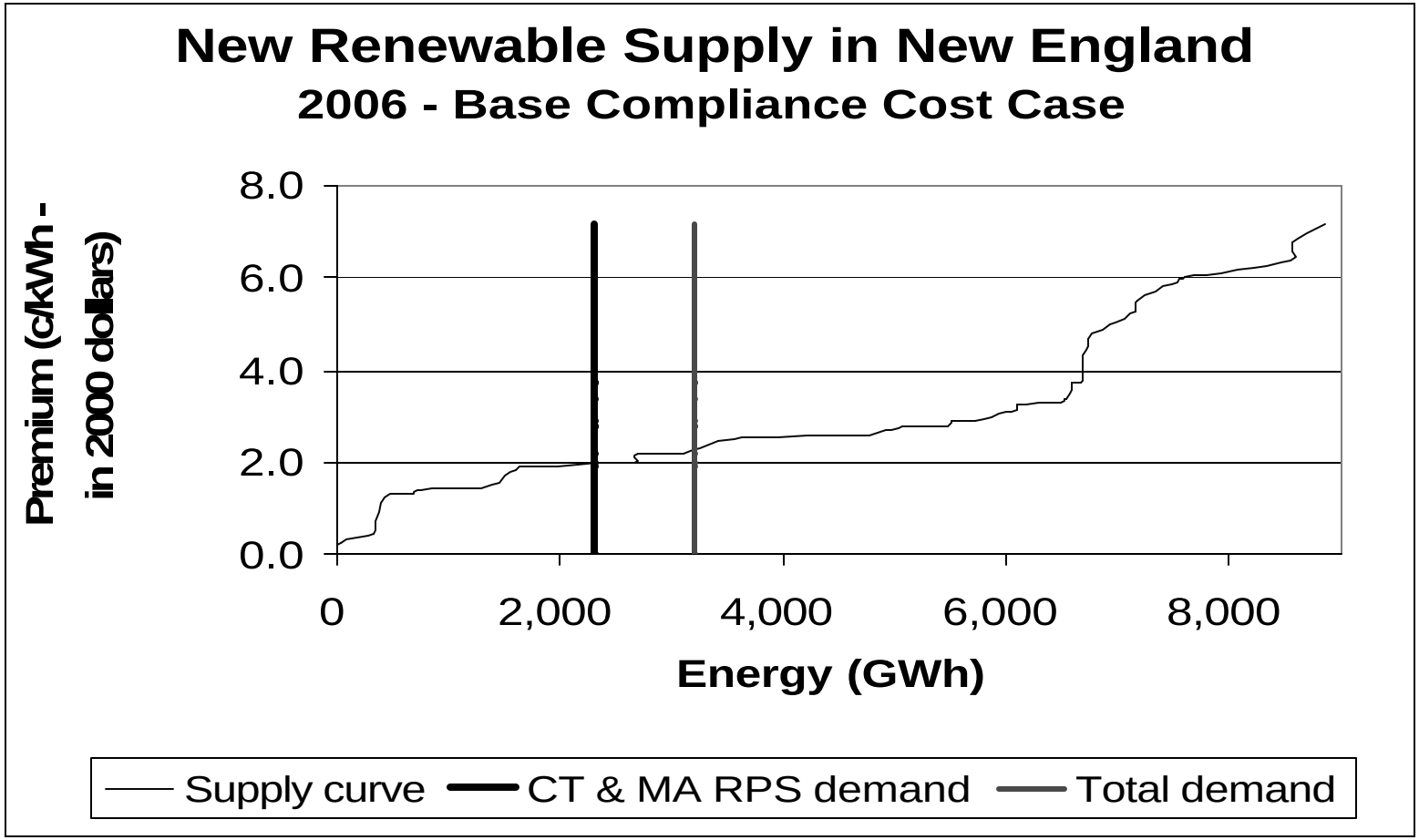
"Incremental Forward Contract Clearing Market"

- Spreadsheet-based model capturing competitive wholesale RPS market characteristics
- *Annual market-clearing* model: renewable energy & attributes sold by generators under long-term contracts to credit-worthy customers in a market for forward contracts that clears each year
- *Clearing price* each year determined by intersection of incremental demand curve with aggregate incremental supply curve
  - supply curves composed of available quantity and cost of eligible renewable supply by resource/technology not previously committed
  - supply curve price is a long-term real levelized cost of each supply block
  - marginal unit sets price for all eligible renewables required in a given year
- Aggregate compliance costs calculated as weighted average of commitments made over time:
  - per-kwh costs under current year and each previous year's each long-term procurement (plus any transaction and admin costs)

Renewable Generation Premium

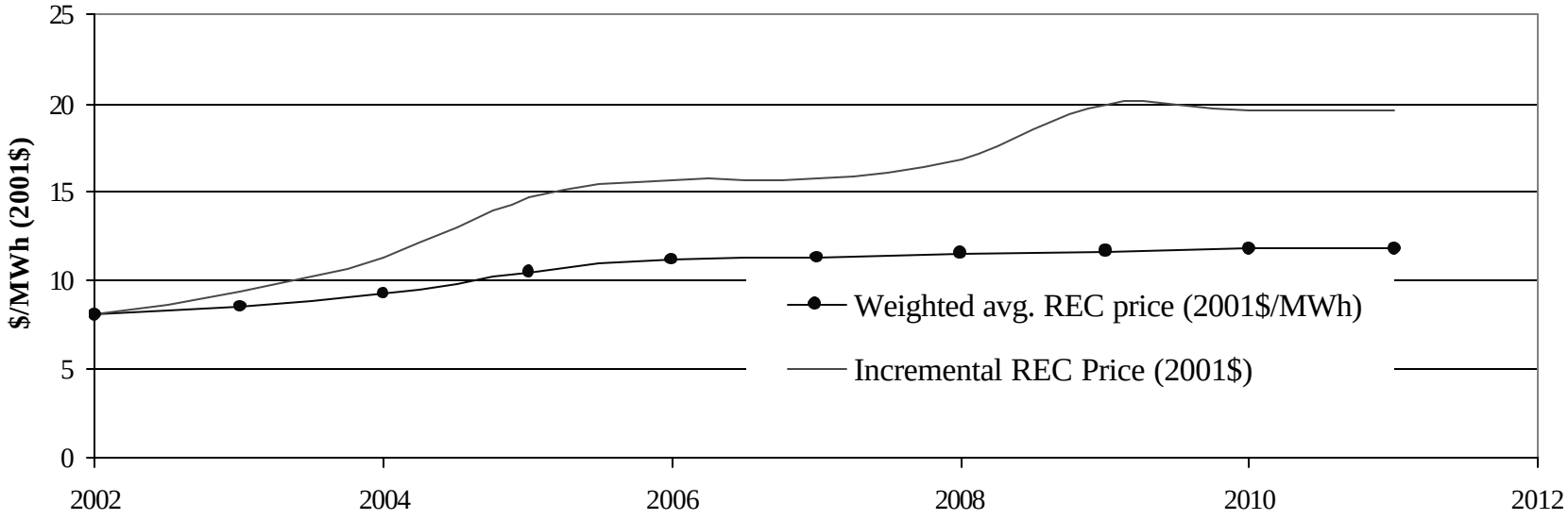
- Supply curve is built, not with absolute cost/MWh for renewable generation, but rather based on the **Renewable Generation Premium (RGP)**, the required premiums over commodity market value for each renewable generator to bring it on-line
  - Accounts for generators having different production profiles, different commodity market values
  - Ex: if plant needs levelized $50/MWh and commodity market value is $35/MWh, its RGP would be $15/MWh
- The market clearing RGP is analogous to the market REC price
- The generator would receive the market value of its production plus the market-clearing RGP (or REC price), analogous to the structure of competitive wholesale electric commodity markets
- So… the approach allows:
  - comparison of renewable generation with different production profiles on an apples-to-apples basis, and
  - Interpretation of results for bundled energy & attributes or attributes-only

Sample Supply Curve from MA Study



Sample of Results from NY EO 111 Study

Figure 1:
Real Renewable Generation Premium (REC Price) - Base Case



Why We Use This Approach

- The project team has extensive experience with traditional utility planning models, BUT we have found that:
  - Behavior of RPS markets using tradable RECs is not necessarily better captured by a dispatch model
  - The uncertainties in assumptions swamp any variations driven by more sophisticated modeling algorithms
  - A spreadsheet modeling approach is far more transparent
  - Exchanging inputs & results iteratively between utility dispatch models and spreadsheet analysis captures much of value of utility dispatch models
- This approach was selected specifically to be transparent and intuitive… and because it is feasible on compressed time frame

Strengths & Weaknesses of Approach

- Pros (Spreadsheet Approach Advantages)
  - Directly addresses unbundled revenue streams & REC markets
  - Transparent, simple and intuitive
    - Can easily depict supply curves, supply stacks, marginal resources
    - Helps focus discussion on assumptions
  - Setup/development: cost and time
  - Far superior for performing sensitivity analyses (ease and speed)
  - Has withstood stakeholder scrutiny
- Cons (Utility Dispatch Modeling Advantages)
  - Can be built on well-understood and accepted dataset if available
  - Lose second-order dynamic feedback effects of electricity and gas supply, demand and prices
    - as a result, spreadsheet tends to slightly overstate societal costs

The New York RPS Analysis

Defining the Parameters

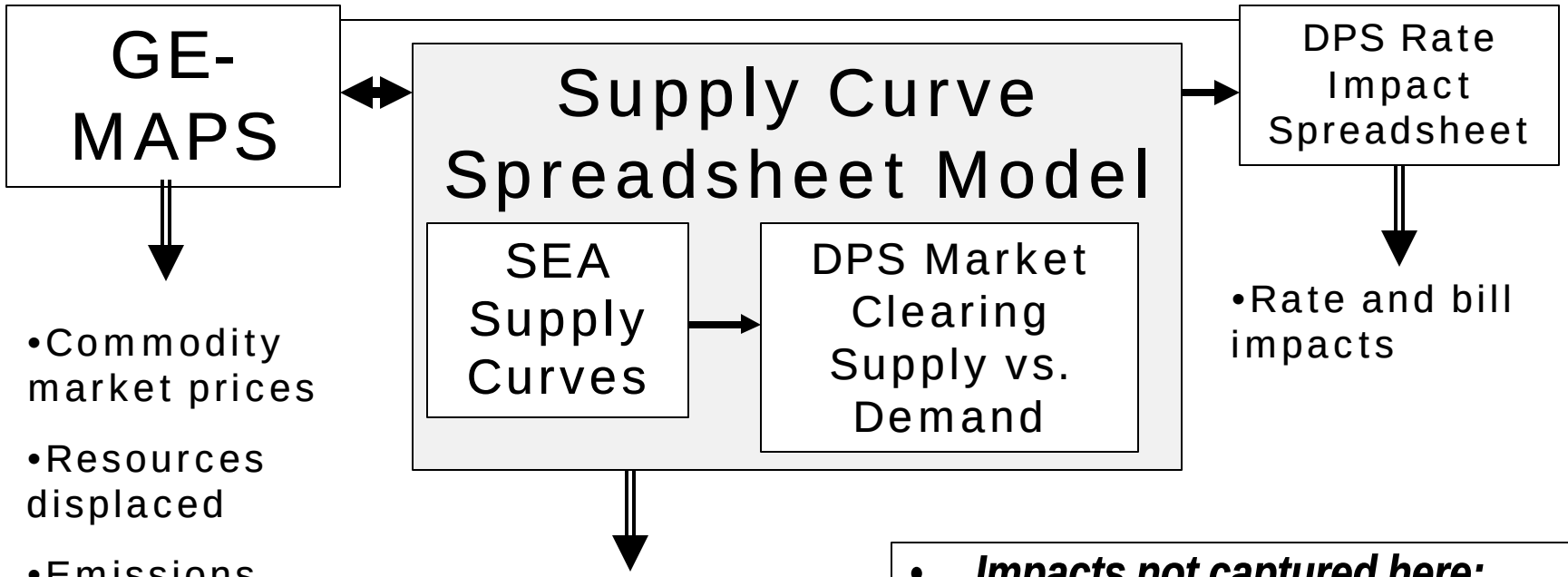
- Define RPS rules & market structure modeled
  - Incremental demand met each year via long-term contracts structured as contracts for differences (CFDs) [e.g. RPS cost = market clearing RGP in year brought on-line less LBMP revenues]
  - Eligible resources (DPS stawman)
  - Geographic eligibility (energy deliverability to NY)
  - 2 tiers: “SBC-like” tier for small customer sited solar PV, wind, fuel cells; all other eligible resources compete head-to-head
  - PTC extended through 2013 for wind, not expanded to other resources/technologies
- Characterize eligible resources and their costs

DPS

SEA

The Full Analysis

(how we fit in the bigger picture)



- Commodity market prices
- Resources displaced
- Emissions impacts
- Indirect electric price suppression

- Direct RPS cost premium over time
- Mix of resources called upon (type, location)

- Rate and bill impacts

- ***Impacts not captured here:***
  - *natural gas price suppression*
  - *economic development benefits*
  - *capacity and ancillary services costs*

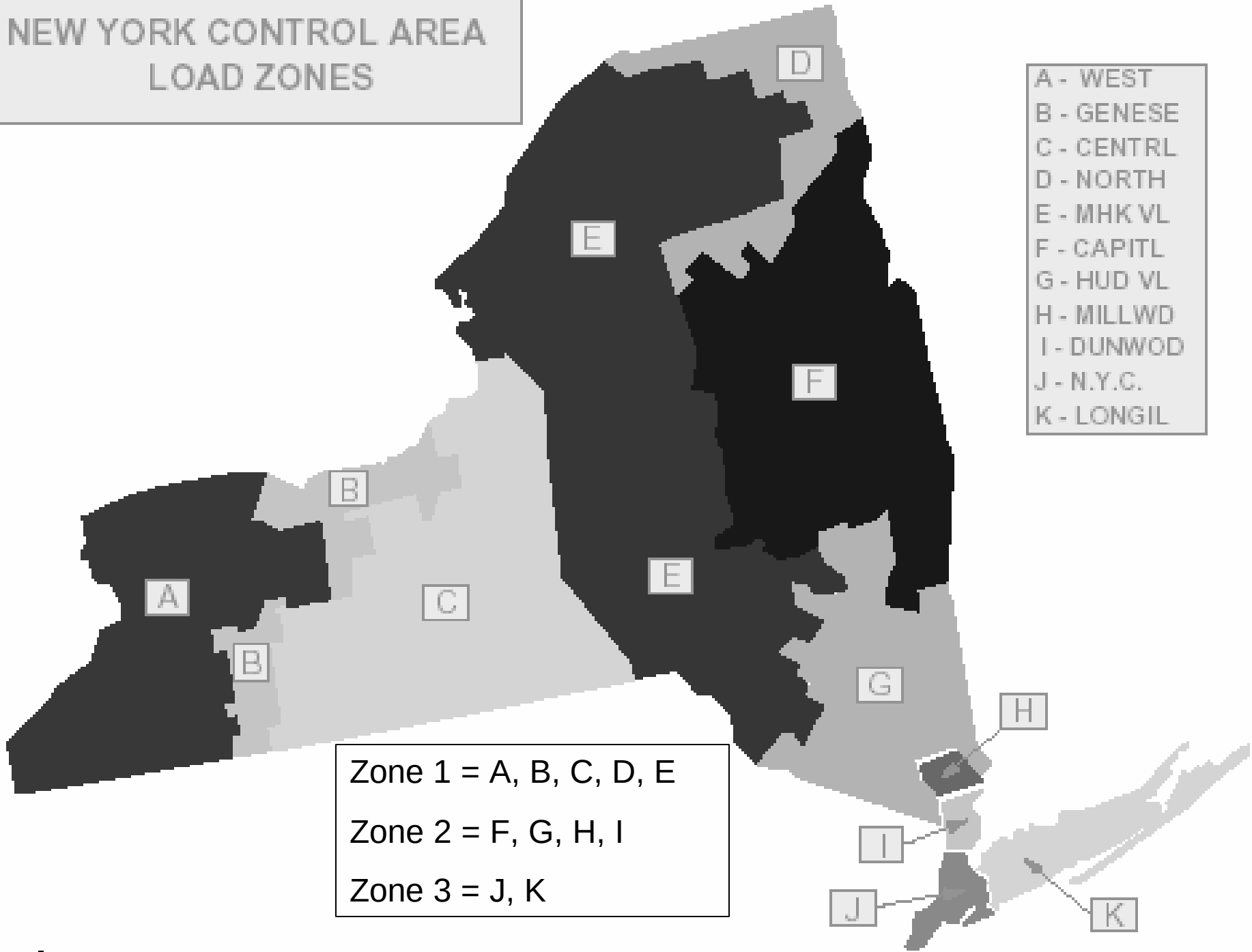
Building Supply Curves [1]

- Create “blocks” of supply by
  - Unit cost ($.MWh)
  - Quantity: GWH/yr, MW, c.f.
  - Resource
  - Location (super-zone, or import source region)
  - Resource quality (where useful, e.g. for wind)
- Levelize cost (in 2003$), considering:
  - Capital & operating costs, project life, financing cost & structure, PTC, interconnection, transmission costs…
  - Depict costs for some technologies declining in real terms

Building Supply Curves [2]

- Determine “commodity market value” absent RPS
  - Function of production profile, commodity market LBMP prices
- Calculate Renewable Generation Premium required to bring each block on-line
  - Cost less commodity market value
- Phase in availability of block (where logical)
  - Evolving market barriers, delivery & manufacturing infrastructure, lead time, permitting constraints, market acceptance, technology availability
- Sort from lowest to highest cost premium to meet RPS demand

NEW YORK CONTROL AREA LOAD ZONES

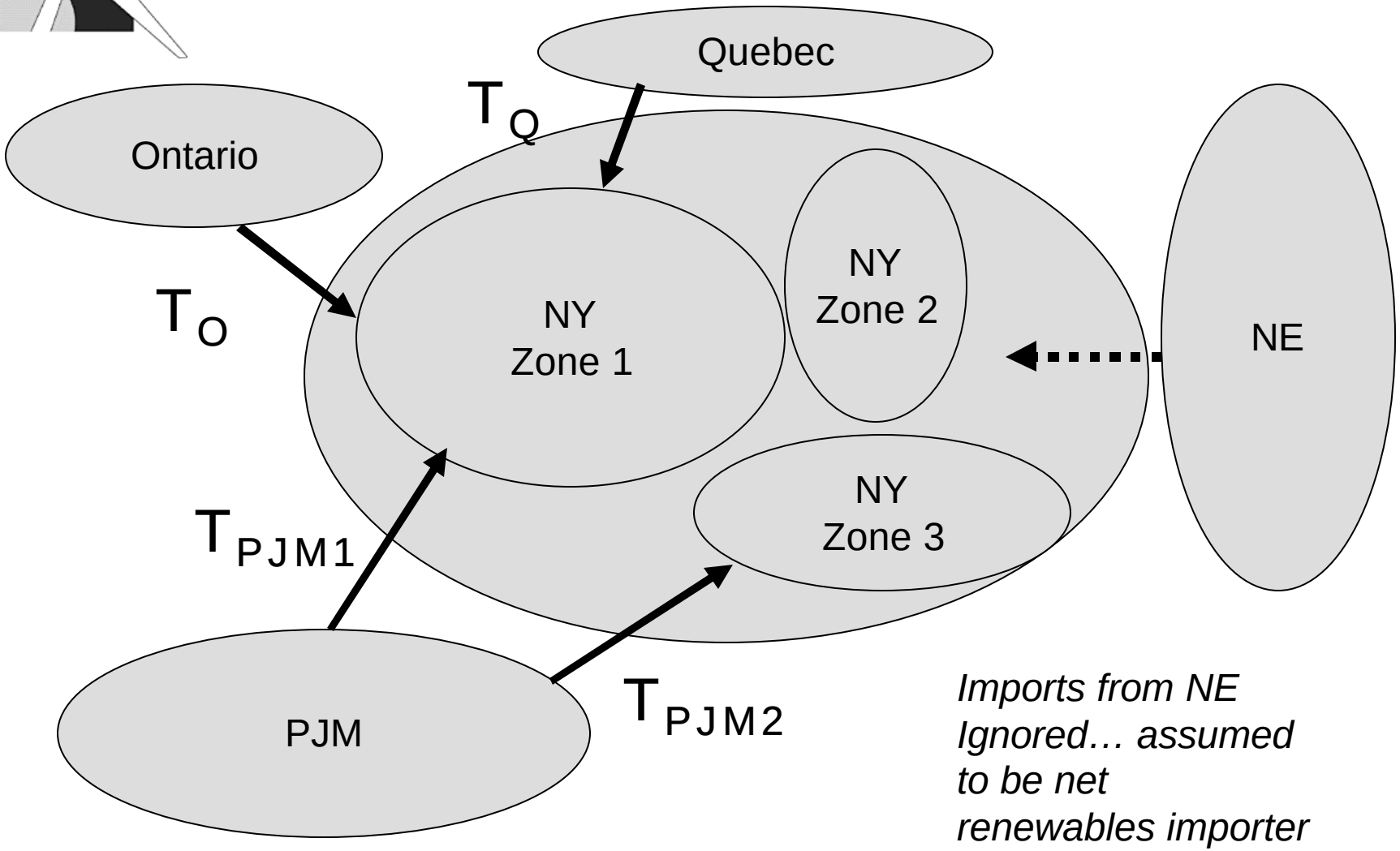


Zone 1 = A, B, C, D, E

Zone 2 = F, G, H, I

Zone 3 = J, K

Deliverability Requirement: Transfer Limits Constrain Imports



Imports from NE Ignored… assumed to be net renewables importer

Preliminary Block Definitions: Primary Tier (head-to-head)

- Wind Farms
  - 3 NY zones; Ontario, Quebec, PJM imports
  - 3 resource quality blocks
- Wind Clusters
  - 3 NY zones
  - 3 resource quality blocks
- Off-Shore Wind
  - NY Lakes & Long Island
- Biomass Co-firing (at existing coal plants)
  - 3 NY zones; Ontario, PJM imports
- Biomass CHP
  - 3 NY zones
- Biomass Gasification (and Fluidized Bed?)
  - 3 NY zones
- Hydro
  - 3 NY zones; Ontario, Quebec imports
  - 3 resource quality blocks: new very small (< 5 MW, NY only); new low-impact (<30 MW); Upgrades to existing facilities
- Landfill gas
  - 3 NY zones
  - Up to 3 resource quality blocks?
- Manure Digestion
  - 3 NY zones

Preliminary Block Definitions: SBC-like Tier

- Solar PV
  - 3 NY zones
  - 3 types – res, C&I, BIPV
- Small wind
  - 3 NY zones
  - 3 resource quality blocks
- Fuel cells
  - 3 NY zones
  - 4 technologies

Independent Data Sources
(no original research)

- "***Energy Efficiency and Renewable Supply Potential in NY State and Five Load zones***"
  - By Optimal Energy, with VEIC, CT Donovan Assoc. & "resource experts" (NYSERDA-funded)
  - Status: draft final report; under review by NYSERDA
  - Objectives: Assess status & potential of EE and RE in New York State. Identify opportunities for Executive Order 111 compliance, New York Energy $mart program; help NYSERDA estimate EE and RE cost-effectiveness; help in drafting State Energy Plan
  - Most recent & comprehensive study, *but* developed for other purposes… for example, no head-to-head competition between renewables
- Other technology characterizations, resource assessments, market characterizations
  - EAI, DOE, NREL, EPRI, National Labs, Natural Resources Canada
  - Industry associations
  - NYISO, Regional studies; State Energy Plan; GE-MAPs datasets
- Complement with:
  - Sources used in our previous Exec. Order 111 study, MA and WI RPS analyses
  - Seasoned professional judgment

Simplifying Assumptions

- Resources modeled are a subset of the feasible range
  - screening of most likely to contribute new RE under a NY RPS
  - E.g. ignore tidal, wave, solar thermal, geothermal, mass-burn biomass
- Condense NY into 3 super-zones
- Ignore imports not expected to play significant role
  - Any imports from New England - expected to be a net importer
  - Resources with small quantities or high costs: Landfill gas, digester, biomass other than coal co-firing
- Capacity and ancillary services revenues addressed by DPS outside of our modeling effort
- Ignore SBC and other subsidies (other than PTC)
- Ignore technological advance impact on capacity factors

➔ *All of above are conservative assumptions*

- Ignore incremental NY green power demand after RPS starts (not conservative, but small)

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